Agricultural Competitiveness

briefing to

ESE Technology Strategy Team Meeting

February 25, 2003
New Orleans, LA

Rodney McKellip
Earth Science Applications
John C. Stennis Space Center

Enabling science and technology for

- Weather and climate for **Energy Forecasting**
- Sequestration capacity monitoring for **Carbon Management**
- Weather and climate for **Agricultural Competitiveness**
- Weather and natural hazards for **Aviation Safety**
- Weather, climate and natural hazards for **Community Growth**
- Early warning for **Homeland Security**
- Early warning for **Public Health**
- Community preparedness for **Disaster Management**
- Environmental Indicators for **Coastal Management**
- Biological **Invasive Species Management**
- **Water Management** and conservation
- Weather and natural hazards for **Air Quality** management

Enabling science and technology for

- Weather and climate for **Energy Forecasting**
- Sequestration capacity monitoring for **Carbon Management**
- Weather and climate for **Agricultural Competitiveness**
- Weather and natural hazards for **Aviation Safety**
- Weather, climate and natural hazards for **Community Growth**
- Early warning for **Homeland Security**
- Early warning for **Public Health**
- Community preparedness for **Disaster Management**
- Environmental Indicators for **Coastal Management**
- Biological **Invasive Species Management**
- **Water Management** and conservation
- Weather and natural hazards for **Air Quality** management

RED indicates targets for new NASA/USDA collaboration

Ag Applications at SSC

Ag20/20	Ag Competitiveness
Focus on tools for utilizing RS in on-farm production management (precision agriculture)	Focus on tools for making regional and national scale production assessments
Partnerships with producers through commodity associations	Partnerships with operational agencies of USDA
Looking at variability across a field – high resolution issues	Looking at variability across a region and over time – lower resolution issues
Driven primarily by commercial high-res multi/hyperspectral imagery	Driven primarily by NASA missions – MODIS, ASTER, LDCM
Decision support tools for making rapid, in-season mgmt decisions	Decision support tools for making planning and marketing decisions, also early warning

Agricultural Competitiveness

Focus: Integrate the new generation of NASA measurement tools into the global agricultural production assessments conducted by USDA

Primary Instruments: MODIS, ASTER, LDCM, GPM

Partners: Primary – USDA Foreign Ag Service

Secondary – USDA National Ag Statistics Service

World Agricultural Outlook Board

National Oceanic & Atmospheric Admin.

Ag Competitiveness: Decision Support Systems

MODELS

RTNEPH
AGRMET
Sinclair
CERES

Data

MEASUREMENTS

MODIS
ASTER
Landsat 5, 7
LDCM
AVHRR
EO-1
AMSR
Airborne data
UAV
TRMM
GRACE
Quickscat
GPM
SSM/I

- aerosol concentration
- chlorophyll-a
- permanent water
- precipitation
- NDVI
- soil moisture
- soil water holding capacity
- evaporation
- solar radiation
- vegetation /crop type
- vegetation green-up
- min/max temperature
- Crop stage/crop stress
- Crop calendars
- Crop yields

DECISION SUPPORT

Agricultural Production

Production Monitoring
- Global Production Estimates
- Yield Estimates
- Drought Impacts

Weather/Climate Tools:
- Seasonal Weather Forecasts
- Short-term Precipitation estimates

Decision Support Systems:
CADRE – USDA Foreign Ag Service (FAS)

VALUE & BENEFITS

- **Decreased production risks**
- **Better input use efficiency**
- **Better market information**
- **Better match of production to environment**
- **Better warning system for production problems**

Agricultural Competitiveness: Partner Agency

USDA Foreign Agriculture Service (FAS)

Production Estimates and Crop Assessment Division (PECAD)

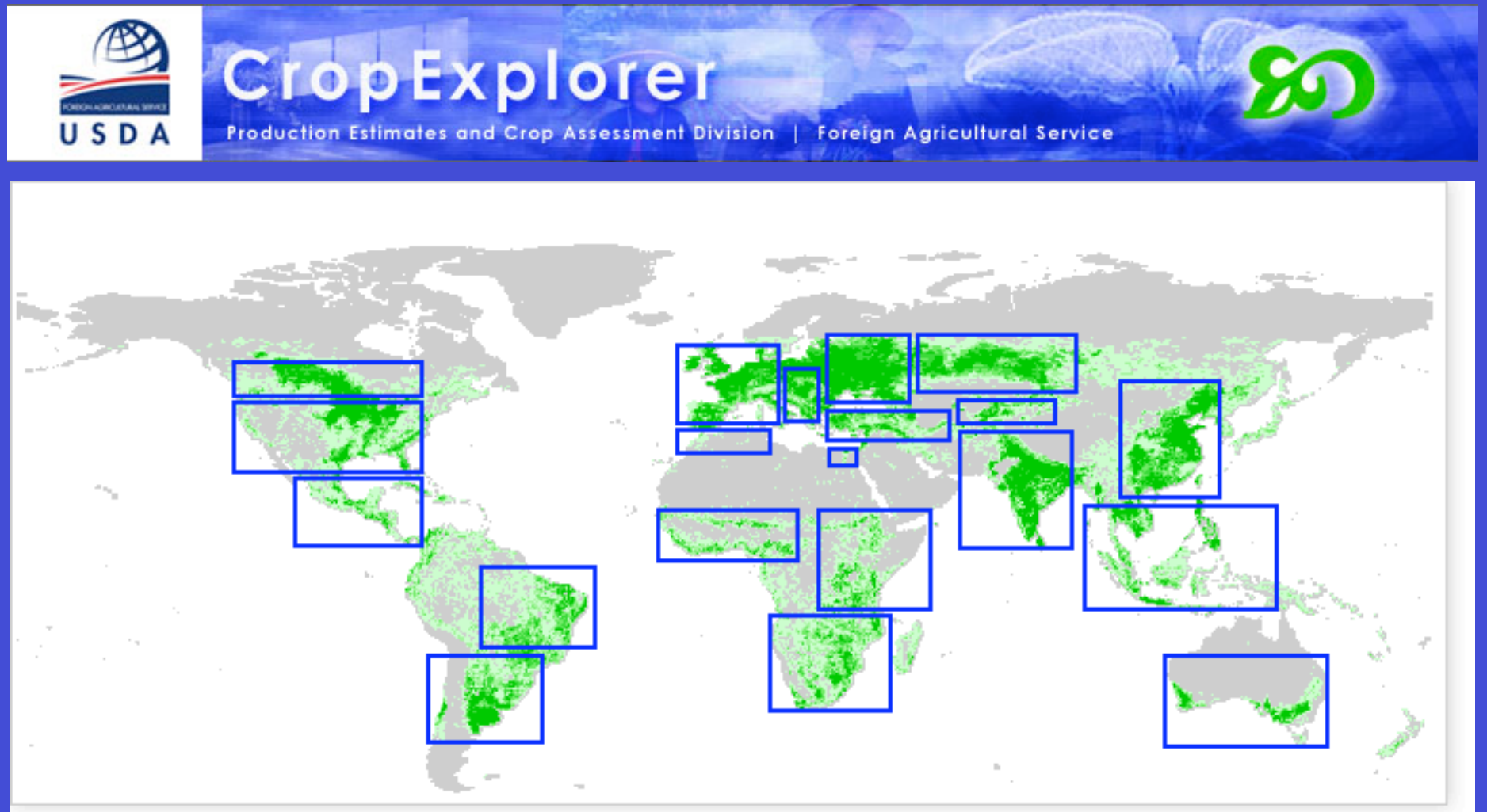
"Producing the most objective and accurate assessment of the global agricultural production outlook and the conditions affecting food security in the world."

What is PECAD?

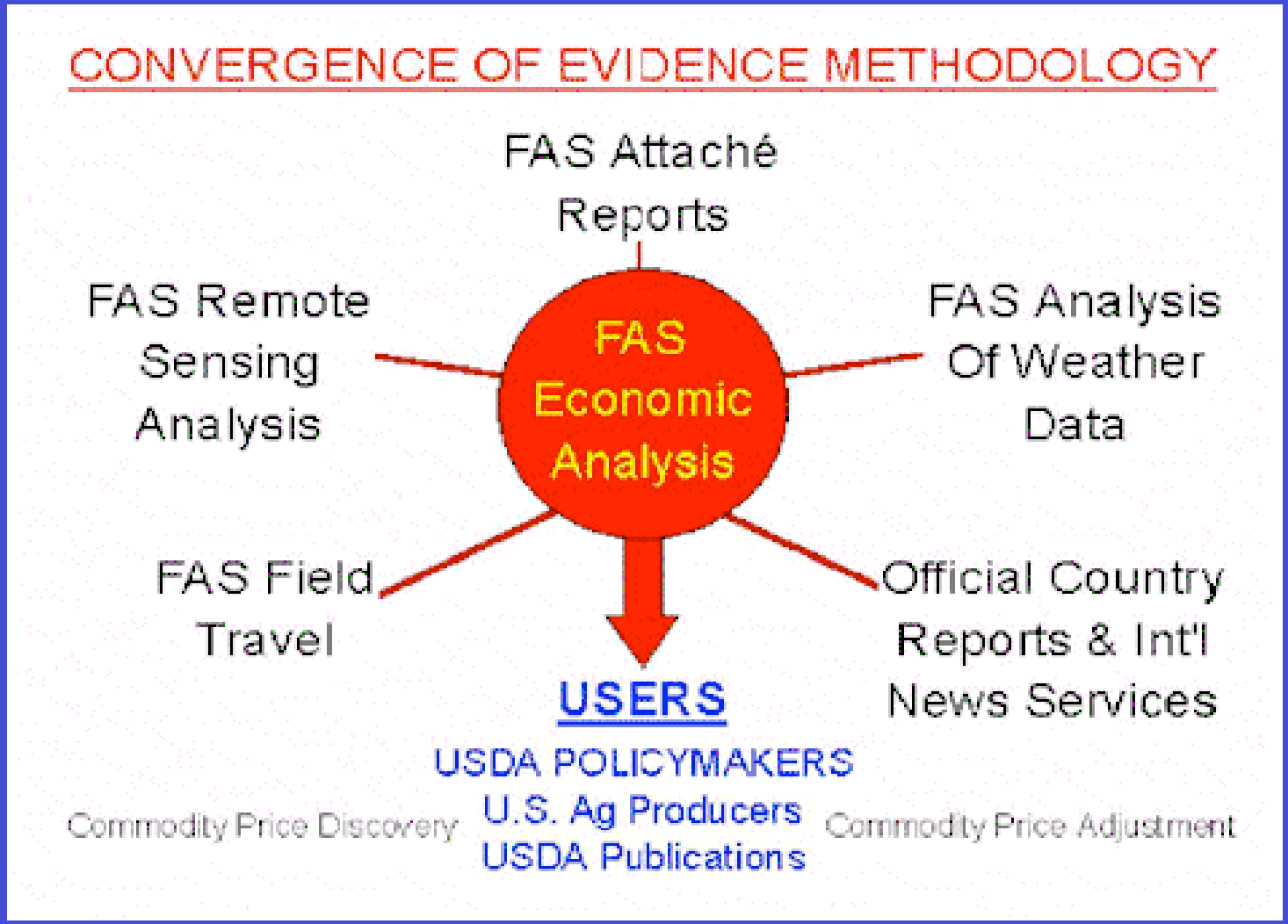
- **Responsible for global crop condition assessments and estimates of area, yield, and production for all major crops**
- **Largest operational user of RS data among civil agencies – mainly AVHRR, Landsat, and SPOT**
- **Utilizes "convergence of evidence" methodology to maximize accuracy:**

Satellite imagery
Weather Data
Economic Data
Crop Models
Ground Truth

USDA-FAS Production Assessments Regions

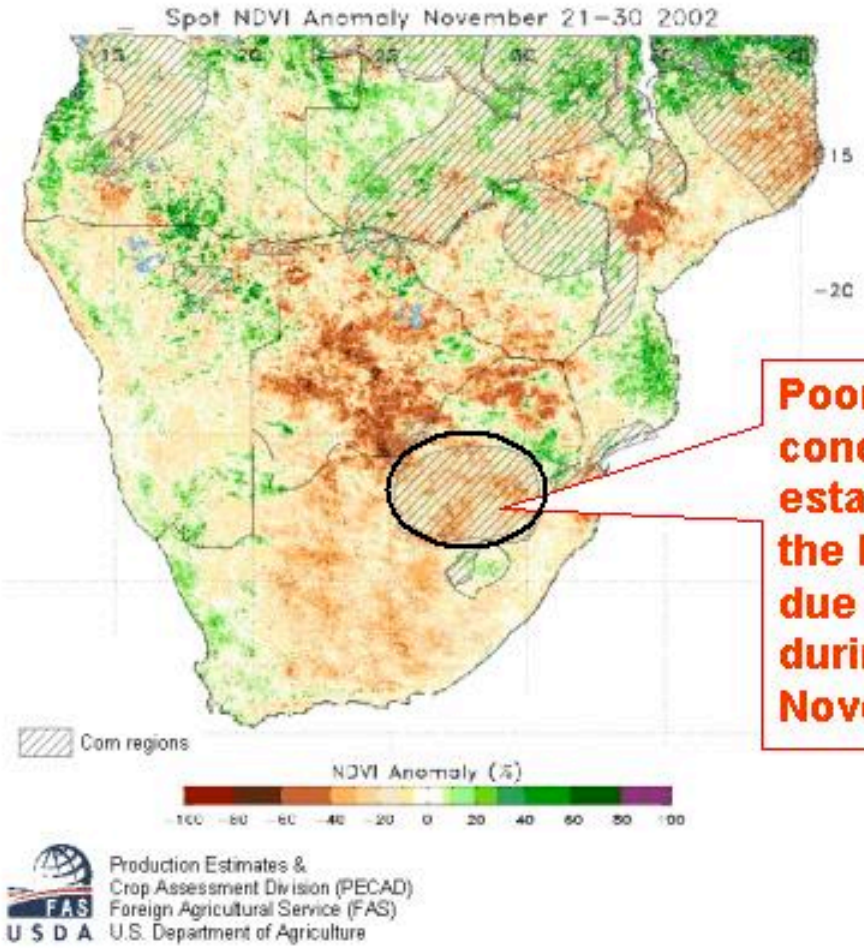


Agriculture - PECAD



USDA-FAD Production Assessments

Southern Africa – Poor Summer Planting Conditions

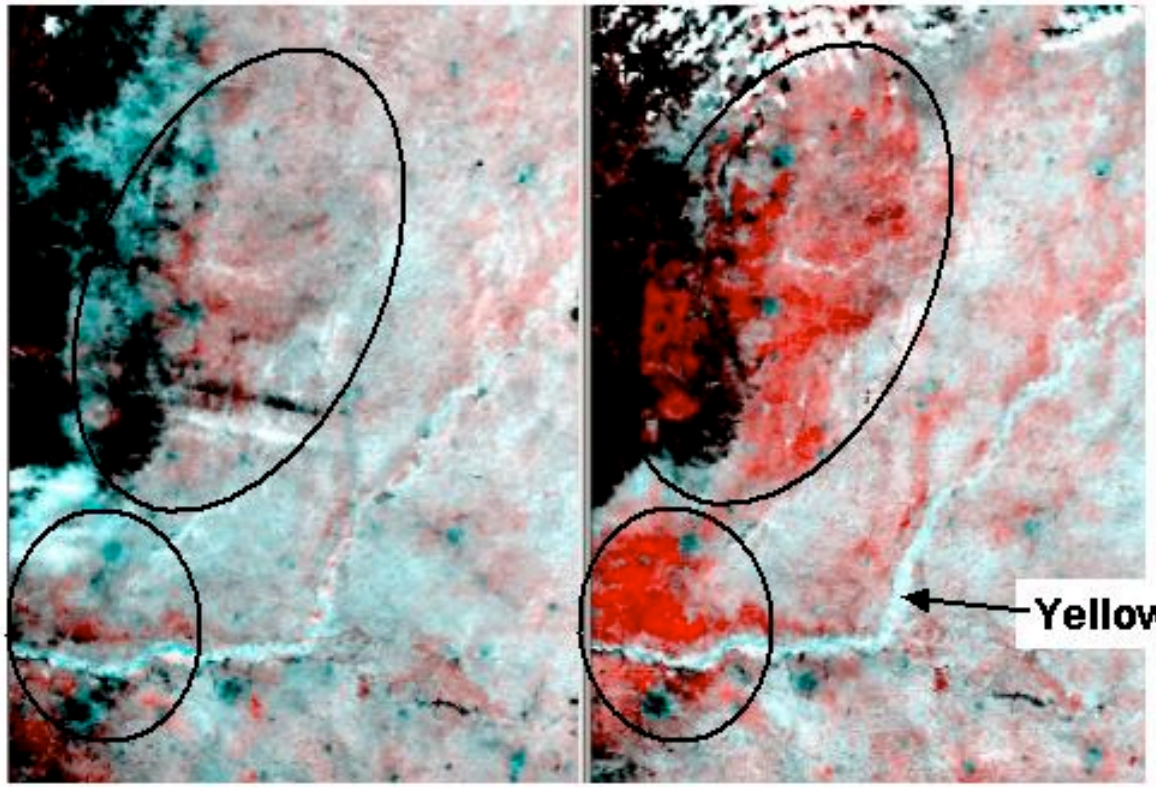


Poor planting conditions and crop establishment within the Maize Triangle due to low rainfall during October and November, 2002

USDA-FAD Production Assessments

China – Poor Winter Wheat Establishment

AVHRR satellite imagery indicates poor winter wheat establishment on the North China Plain compared to last year. Rainfall was lower than normal this fall and soils are very dry.

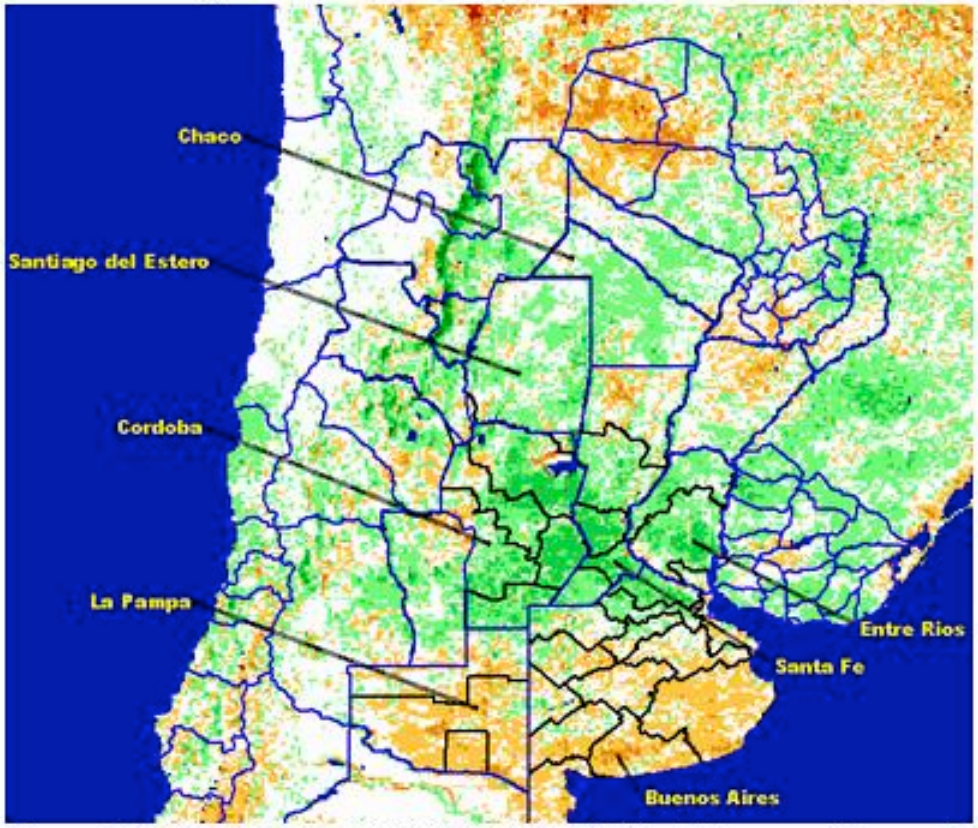


11 November 2002 **14 November 2001**

USDA-FAD Production Assessments

Vegetation Conditions Are Better in Central Argentina

GAC 10-Day NDVI Compared to Normal: Jan. 21 to Jan. 31, 2003



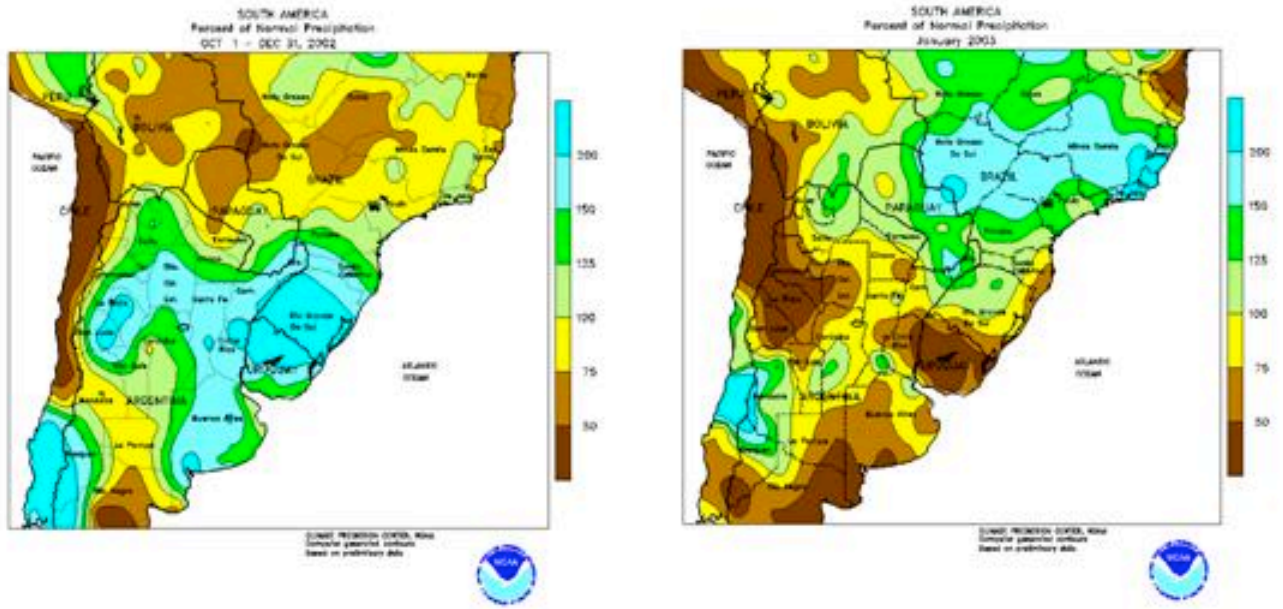
- Vegetation conditions in central Argentina are better than normal.
- In southern Buenos Aires and La Pampa Provinces, vegetation is less than normal, showing effect of high heat and low soil moisture.

Source: USDA/FAS/PECAD and NOAA/AVHRR GAC-10 day NDVI compared to normal.

USDA/FAS/PECAD
Robert.tetrault@usda.gov

PECAD Weather Monitoring

Above-normal Rainfall Sustains Crops Through January Dryness



- Above-normal precipitation in October through December (left side) improved yield prospects for corn in Argentina.
- Below-normal precipitation in January (right side) affected late developing corn in southern Buenos Aires and La Pampa Provinces.

USDA/FAS/PECAD
Robert.tetrault@usda.gov

World Crop Production Summary – Feb. 2003

Commodity	World	Total Foreign	North America			Europe			FSU-12
			United States	Canada	Mexico	European Union	Oth. W. Europe	Eastern Europe	
	---Million metric tons---								
Wheat									
2000/01	583.66	522.90	60.76	26.52	3.40	104.73	0.90	28.87	62.95
2001/02 prel.	579.00	525.73	53.26	20.57	3.27	91.20	0.77	34.71	91.33
2002/03 proj.									
Jan.	567.51	523.52	43.99	15.70	3.15	103.70	0.89	30.79	95.75
Feb.	566.64	522.65	43.99	15.70	3.15	103.32	0.89	30.79	96.58
Coarse Grains									
2000/01	859.82	586.69	273.13	24.03	24.46	107.38	1.59	37.01	49.49
2001/02 prel.	888.96	627.10	261.86	22.60	27.17	106.67	1.54	52.09	62.35
2002/03 proj.									
Jan.	859.95	614.91	245.04	19.59	25.37	105.14	1.69	49.28	60.83
Feb.	861.59	616.55	245.04	19.59	25.37	106.07	1.69	49.36	60.53
Rice (Milled)									
2000/01	397.91	391.97	5.94	0.00	0.22	1.57	0.00	0.04	0.71
2001/02 prel.	398.44	391.71	6.74	0.00	0.19	1.62	0.00	0.04	0.62
2002/03 proj.									
Jan.	380.28	373.67	6.60	0.00	0.20	1.79	0.00	0.04	0.72
Feb.	381.69	375.09	6.60	0.00	0.16	1.79	0.00	0.04	0.69
Total Grains 1/									
2000/01	1,841.39	1,501.56	339.83	50.55	28.07	213.68	2.49	65.91	113.14
2001/02 prel.	1,866.40	1,544.54	321.86	43.17	30.62	199.49	2.31	86.84	154.30
2002/03 proj.									
Jan.	1,807.73	1,512.09	295.64	35.29	28.72	210.63	2.58	80.10	157.31
Feb.	1,809.93	1,514.29	295.64	35.29	28.68	211.18	2.58	80.18	157.80

The FAS convergence of evidence methodology results in monthly updates to world production estimates

FAS Challenges

- Highly operational, time-sensitive environment with little opportunity for separate prototypes
- Information reliability is crucial – must be cautious introducing experimental data streams
- Atypical DSS environment highly dependent on the analyst's use of evidence
- Convergence of evidence system makes quantification of performance improvement difficult

Agricultural Competitiveness

FY03 Activities

- Assemble Integrated Product Team to lead the effort (SSC has lead for Ag Competitiveness)
- Establish Formal relationship with USDA
- Conduct joint requirements workshop with USDA
- Negotiate partnership project with the Univ. of Maryland to initiate a MODIS Rapid Response System for the Foreign Ag Service
- Conduct baseline analysis of the USDA-FAS Production Estimates and Crop Assessment Division (PECAD) decision support tools

Agricultural Competitiveness

Building a relationship with USDA:

- Interagency team created in Spring of 2001 to chart the course for expanded collaboration between the two agencies, led by Ron Birk of NASA and Dr. Rod Brown of USDA
- Five of the twelve applications identified by USDA as having primary applicability to agriculture
- A new MOU between Admin. O'Keefe and Secretary Veneman will formalize the new partnership
- Planning a March 2003 Workshop in Denver entitled *Agricultural Decision Support Systems* to further develop the roadmaps for USDA/NASA collaboration in the five focus areas

Agriculture – Univ. of MD Project

Project Title: Application of NASA EOS MODIS Data by USDA Foreign Agriculture Service

PI: Dr. Chris Justice
Univ. of Maryland

Partners: USDA-FAS
GSFC

Funding: 3 Yrs, $823K
Match of $787K from USDA

NASA Roles in Cooperative Agreement:

- Benchmarking of FAS DSS (w/Univ. of Arizona)
- Filed validation support at domestic test sites
- Performance validation of FAS DSS with new products

Objectives:

1. Delivery of Rapid Response MODIS data and enhanced MODIS products into FAS monitoring system
2. Development of new RR MODIS veg condition and crop stress products and integration of MODIS data into regional crop prediction model
3. R&D to establish the relationship between MODIS veg products and historical AVHRR/SPOT baseline
4. Development of web-based MODIS information delivery system